

**Total Ionizing Dose Test:
54ACTQ16244, 16 Bit Buffer/Line Driver with Tri-State Outputs
(National Semiconductor)**

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1. Introduction

A radiation evaluation was performed on the 54ACTQ16244 16 Bit Buffer/Line Driver with Tri-State Outputs to determine its tolerance to total ionizing dose radiation.

2. Part Information

Table I contains information about the 54ACTQ16244. Fig. 1 shows the pin-out.

Table I.
Part Information

Generic Part Number:	54ACTQ16244
Full Part Number:	5962-9561901QXA
Manufacturer:	National Semiconductor
Lot Date Code (LDC):	0435
Quantity Tested:	5
Serial Numbers of Control Sample:	5
Serial Numbers of Radiation Samples:	1, 2, 3, 4
Part Function:	16-Bit Buffer/Line Driver with Tri-State Outputs
Part Technology:	CMOS
Package Style:	48 Pin Flat Pack
Test Equipment:	Parametric Analyzer, dual power supply
Test Engineer:	J. Forney
Exposure Levels:	0, 10, 20, 30, 50, 75, 100
Target Dose Rate:	2 rads(Si)/s

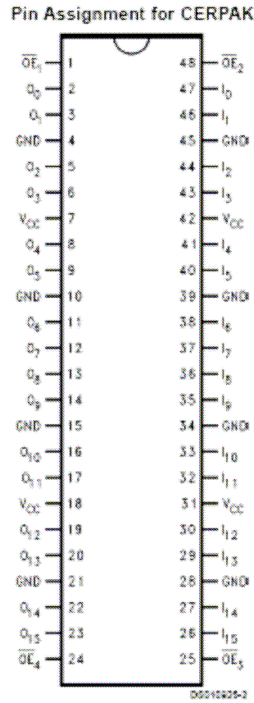


Fig. 1. Pin-out for the ACTQ16244.

3. Test Method

Total dose testing was performed by exposing the parts under bias to a source of gamma radiation emanating from a Co^{60} cell at NASA-GSFC. Five parts were irradiated and there was one control device. The parts were biased with $V_{dd} = 5\text{V}$, $V_{ss} = \text{gnd}$, the outputs were left floating and the inputs were grounded. Total dose radiation levels were 1, 5, 10, 20, 40, 75 and 100 krad(Si), and the dose rate was 2 rads(Si)/s. Parametric measurements were done by scanning the input voltage from 0 V to 5 V in steps of 0.1 V and measuring, at each step, the output voltage, the input current and the supply current.

Initial electrical measurements were made on 5 samples with one being a control. After each radiation exposure, parts were electrically tested to determine if there were any changes in parametric values. The values of the electrical parameters given in the data sheet are listed in Table II.

Table II
Specified Parametric Values as a Function of Total Dose

Parameter	Value	Condition
Minimum High Output Voltage	4.900 V	$V_{cc} = 5\text{V}$, $V_{out} = 0.1\text{V}$
Maximum Low Output Voltage	0.100 V	$V_{cc} = 5\text{V}$
Maximum Input Leakage Current	+/- 1 μA	$V_{in} = V_{cc} = 5\text{V}$
Maximum Supply Current	1.6 mA/input	$V_{in} = V_{cc} - 2.1\text{V}$

4. Results

The following tables show the results of the electrical parametric measurements performed after various levels of total dose.

Table III
Output Voltage (Low) as a Function of Total Dose

TID	DUT#1	DUT#2	DUT#3	DUT#4	Average	St. Dev.
0	6.00E-05	-2.00E-05	2.00E-04	1.14E-03	3.45E-04	5.38E-04
10	2.20E-04	1.60E-04	-2.00E-05	1.60E-03	4.90E-04	7.47E-04
30	7.20E-04	1.02E-03	1.00E-03	2.78E-03	1.38E-03	9.43E-04
50	3.04E-03	3.28E-03	3.32E-03	4.42E-03	3.52E-03	6.16E-04
100	5.54E-03	6.44E-03	8.54E-03	6.94E-03	6.87E-03	1.26E-03

Table IV
Output Voltage (High) as a Function of Total Dose

TID	DUT1	DUT2	DUT3	DUT4	Average	St. Dev.
0	5.001	5.000	5.001	4.998	5.000	0.001
10	5.000	5.000	5.000	4.997	4.999	0.001
30	4.999	4.999	4.999	4.996	4.998	0.001
50	4.997	4.996	4.997	4.994	4.996	0.001
75	4.996	4.996	4.996	4.996	4.996	0.000
100	4.995	4.992	4.994	4.993	4.993	0.001

Table VI
Power Supply Current as a Function of Total Dose

TID	DUT#1	DUT#2	DUT#3	DUT#4	Average	St. Dev.
0	1.382E-10	1.2630E-10	1.46E-10	2.67E-03	6.69E-04	1.34E-03
10	5.495E-05	5.11E-05	6.12E-05	4.66E-03	1.21E-03	2.30E-03
30	1.458E-03	1.66E-03	1.58E-03	6.06E-03	2.69E-03	2.25E-03
50	4.731E-03	5.26E-03	4.89E-03	8.96E-03	5.96E-03	2.01E-03
75	5.886E-03	6.57E-03	6.09E-03	6.71E-03	6.31E-03	3.90E-04
100	8.823E-03	1.02E-02	9.35E-03	1.07E-02	9.77E-03	8.50E-04

Table VII
Input Bias Current as a Function of Total Dose

TID	DUT#1	DUT#2	DUT#3	DUT#4	Average	St. Dev.
0	1.290E-10	1.201E-11	1.034E-11	5.790E-12	3.928E-11	5.986E-11
10	1.069E-10	1.716E-10	1.473E-10	1.425E-10	1.421E-10	2.670E-11
30	1.053E-10	1.377E-10	1.671E-10	1.320E-10	1.355E-10	2.536E-11
50	1.317E-10	1.532E-10	1.112E-10	1.697E-10	1.414E-10	2.548E-11
75	1.006E-10	1.290E-10	7.851E-11	1.148E-10	1.057E-10	2.153E-11
100	7.349E-11	1.320E-10	1.164E-10	9.387E-11	1.039E-10	2.562E-11

5. Conclusion

Electrical parametric measurements were all within specifications after exposure to a total ionizing dose of 100 krad(Si).